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FORMULA EVALUATOR'S GEODETIC FUNCTIONS

General

About this document

This document describes the geodetic functions of the formula evaluator, which is fully described in document Evaluator.doc.

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Geodetic functions

GCNV, datum and coordinate format conversion

```
GCNV(Latitude;Longitude;Height;Zone;INDATUM;INCRDTYPE;INXYID;OUTDATUM;OUTCR
DTYPE;OUTXYID)
```

Function returns output values: Latitude; Longitude; Height; Zone

No	Parameter	Default value	Comment
1	Latitude	0	in INCRDTYPE format
2	Longitude	0	in INCRDTYPE format
3	Height	0	Height above ellipsoid
4	Zone	None	
5	INDATUM	WGS84	
6	INCRDTYPE	D	
7	INXYID	None	
8	OUTDATUM	WGS84	
9	OUTCRDTYPE	DEG	
10	OUTXYID	None	

DIST, Distance between points

```
DIST(Latitude1;Longitude1;Height1;Zone1;DATUM1;CRDTYPE1;XYID1;
Latitude2;Longitude2;Height2;Zone2;DATUM2;CRDTYPE2;XYID2)
```

BEAR, Bearing between points

```
BEAR(Latitude1;Longitude1;Height1;Zone1;DATUM1;CRDTYPE1;XYID1;
Latitude2;Longitude2;Height2;Zone2;DATUM2;CRDTYPE2;XYID2)
```

No		Parameter	Default value	Comment
1	Point 1	Latitude1	0	in CRDTYPE1 format
2		Longitude1	0	in CRDTYPE1 format
3		Height1	0	Height above ellipsoid
4		Zone1	None	
5		DATUM1	WGS84	
6		CRDTYPE1	D	
7		XYID1	None	
8	Point 2	Latitude2	0	in CRDTYPE2 format
9		Longitude2	0	in CRDTYPE2 format
10		Height2	0	Height above ellipsoid
11		Zone2	None	
12		DATUM2	WGS84	
13		CRDTYPE2	D	
14		XYID2	None	

Examples of the usage of the geodetic functions

Geodetic function can be used directly in their full format. e.g.

```
CCNV:(N60 23 06.384;E19 50 53.292;118.3;;ETRS89;D;;ETRS89;"ETRS-TM35FIN 3"
Returns: 6715706.377;106256.360;118.3
```

Often you need to convert lots of coordinates between two coordinate systems, and then most of the parameters retain their values between conversions. In such case it is convenient to define user defined functions, where the non-changing parameters are considered fixed.

Sample definition, DEG2UTM, coordinate values to UTM coordinates:

```
FVALUE FUNCTION.DEG2UTM=CCNV:(P:1;P:2;;;;D;;;UTM)
```

Usage example of DEG2UTM:

```
DEG2UTM:(N60 23 06.38474; E19 50 53.29237
Returns: 6694856;436502;0;34V
```

Sample definition, DIST2, simpler distance function:

```
DIST2=DIST:(P:1;P:2;;;;;;P:3;P:4)
```

Usage example of DIST2:

```
dist2:(60;24;60.1;24.2
Returns: 15757.48609285803
```

More examples from Geofuncs.bat:

```
rem    d2dms:(lat;lon)
fvalue function.d2dms=ccnv:(p:1;p:2;;;;d;;;dms s3;)

rem    d2dm:(lat;lon)
fvalue function.d2dm=ccnv:(p:1;p:2;;;;d;;;deg s3;)

rem    d2deg:(lat;lon)
fvalue function.d2deg=ccnv:(p:1;p:2;;;;d;;;deg s3;)

rem    deg2utm:(lat;lon)
fvalue function.deg2utm=ccnv:(p:1;p:2;;;;d;;;utm)

rem    utm2deg:(northing;easting;zone)
fvalue function.utm2deg=ccnv:(p:1;p:2;;p3;;utm;;;deg)

rem    datum conversion: wgs842rt90:(lat;lon)
fvalue function.wgs842rt90=ccnv:(p:1;p:2;;;wgs84;d;;rt90;dms S3)

rem    datum conversion: rt902wgs84:(lat;lon)
fvalue function.rt902wgs84=ccnv:(p:1;p:2;;;rt90;d;;wgs84;dms S3)

rem    grid conversion: wgs842osgb36:(lat;lon)
fvalue function.wgs842osgb36=ccnv:(p:1;p:2;;;wgs84;d;;;tm S3;osgb36)

rem    grid conversion: osgb362wgs84:(northing;easting)
fvalue function.osgb362wgs84=ccnv:(p:1;p:2;;;;tm;osgb36;wgs84;dms S3)
```

Parameters of the geodetic functions

INDATUM=Input-datum

Indatum is user-defined only if coordinate-type (INCRDTYPE) is D, DEG, DM or DMS.

Evaluator reads input-datum parameters from parameter-file DATUM.VAL, see section "Parameter Files".

OUTDATUM=Output-datum

Outdatum is user-defined only if coordinate type (OUTCRDTYPE) is DEG,DM or DMS.

Evaluator reads output-datum parameters from parameter-file DATUM.VAL, see section "Parameter Files".

INCRDTYPE=type of the input-coordinates

D = General degree-input-format
D,separator character= General degree-input-format + separator character definition

In this format space (default) or 'separator character' is used as the separator between degrees, minutes and seconds. This format is most general and can be applied to most cases

In this format you can present

- degrees
- degrees and minutes
- or degrees, minutes an seconds

providing, that one or more spaces are used as a separator between degrees, minutes and seconds.

E.g.:

```
-17,8726448         Right (degrees)
+16.34324234        Right (degrees)
60 23 06.38474      Right (degrees, minutes and seconds)
+602306.38474       Wrong - separators missing
60 23   6.38474     Right - separator can be more than one space
```

DEG = Degrees and decimals of degrees
DM = Degrees, minutes and decimals of minutes
DMS = Degrees, minutes, seconds and decimals of seconds

In types DEG, DM and DMS spaces don't serve as separators between degrees, minutes and seconds, but spaces can be used to increase readability. Therefore you can freely use spaces, but the integer parts of minutes and seconds must have two numbers, that is, numbers less than 10 must be preceded by zero.

E.g.:

```
60 23 06.38474      Correct
+602306.38474       Correct - separators aren't mandatory
60 23  6.38474      Wrong - seconds should be preceded by zero
```

In all formats minus-character or characters S or W (South and West) in any part of the coordinate-value indicates negative value.

E.g.:

```
-20 13 14.5          Negative
20 13 15.5 W         Negative
```

In all formats you can use both period and comma as decimal point, except when used in a parameter list, where comma is used as a field separator.

E.g.:

```
-17,8726448          Right (comma)
+16.34324234         Right (period)
```

GON = Gon, grad

Degree-format, where full circle is 400 degrees. Alternative is to include character G in the expression, e.g. 40.1523G. In that case the expression is regarded as gons regardless of the INCRDTYPE.

```
200G                 180 degrees
```

UTM = Universal Transverse Mercator

When INCRDTYPE is UTM, Evaluator reads the zone information from INZONECOL. The zone information consists of the Zone-Number (1-60) and the Band-Letter (CDEFGHJKLMNPQRSTUVWX), e.g. 14V. Evaluator also checks, if the zone field also contains the easting and northing values as in standard UTM-coordinate format, e.g. in the second column below. N/B, that the easting value comes in standard UTM format before the northing value.

```
000001,32U 579522.770 5551699.893
000002,34V 388455.958 6653097.435
000003,29U 420477.230 5551699.893
000004,27V 611544.042 6653097.435
000005,32F 579522.770 4448300.107
```

If the zone-field contains the zone information only without easting and northing, Evaluator reads the northing value from INLATCOL and the easting value from INLONCOL, e.g.

```
INIDCOL=1
INZONECOL=2
INLATCOL=3
INLONCOL=4

000001, 32U, 5551699.893, 579522.770
000002, 34V, 6653097.435, 388455.958
000003, 29U, 5551699.893, 420477.230
000004, 27V, 6653097.435, 611544.042
```

Evaluator assumes UTM to be defined between latitudes –80 and +84.

Evaluator gets the standard UTM parameters internally. Therefore there is no need to define UTM-grid parameters in the parameter file XYPARA.VAL. The standard parameters are:

Parameter	Value
Datum	From parameter UTMDATUM or if missing, WGS84
Central Meridian	6*Zonenumber –183
Latitude of Origin	0
False Easting	500000
False Northing	0 in the northern hemisphere and 10000000 in the southern hemisphere
Scale Factor at Central Meridian	0.9996 (exactly)

Following zones use exceptional parameters (according to the UTM standard). If the input-data contains references to the missing zones 32X, 34X or 36X, these zones are handled like standard zones.

Zone	Central Meridian	Width	Comment
31X	4,5	9	
33X	15	12	
35X	27	12	
37X	37,5	9	
31V	1,5	3	
32V	7,5	9	
32X			Missing, because of the expanded zones 31X and 33X
34X			Missing, because of the expanded zones 33X and 35X
36X			Missing, because of the expanded zones 35X and 37X

However, if there is a need to use other parameter values than the internal standard values in association with some UTM-zone (number and band), these values can be defined in the parameter-file XYPARA.VAL with grid-name UTM+ZoneNumber+BandLetter, e.g. INXYID=UTM04V. Only the exceptional values need to be defined and the rest of the fields may be left empty. In the example below the datum for UTM-zone 14V is changed to NAD27. The extra commas after NAD27 are not mandatory.

```
Name=Datum,CEM,LAO,FAE,FAN,SCF,Width, Free text
UTM14V=NAD27,,,,,
OSGB36=OSGB36,-2,49,400000,-100000,0.9996012717
```

TM = Transverse Mercator / Gauss-Krüger projected coordinates

User defined Transverse Mercator projected coordinate format. When this coordinate format is used, conversion parameters between the geodetic and grid-coordinates must be defined in the parameter file XYPARA.VAL and the parameter ID must be set using the parameter INXYID.

Fore more details about the needed parameters see section 'Parameter Files", XYPARA.VAL.

LCC1SP = Lambert Conic Conformal projected coordinates, one standard parallel
LCC2SP = Lambert Conic Conformal projected coordinates, two standard parallels

User defined Lambert Conic Conformal projected coordinate format. When this coordinate format is used, conversion parameters between the geodetic and grid-coordinates must be defined in the parameter file XYPARA.VAL and the parameter ID must be set using the parameter INXYID.

Fore more details about the needed parameters see section 'Parameter Files", XYPARA.VAL.

MERC1SP = Mercator projected coordinates, one standard parallel
MERC2SP = Mercator projected coordinates, two standard parallels

User defined Mercator projected coordinate format.

MERC1SP is the normal Mercator projection, where the only standard parallel is equator. MERC2SP is rarely used Mercator projection with two standard parallels.

When this coordinate format is used, conversion parameters between the geodetic and grid-coordinates must be defined in the parameter file XYPARA.VAL and the parameter ID must be set using the parameter INXYID.

Fore more details about the needed parameters see section 'Parameter Files", XYPARA.VAL.

KKJ = Finnish National Grid-coordinates

The zone is defined by the first number of y-coordinate. The conversion is three dimensional seven parameter similarity transformation using datum KKJ. See parameter INDATUM for the transformation parameters. Conversion parameters between KKJ-xy-coordinates and geographical coordinates are described in parameters file XYPARA.VAL, see section "Parameter Files".

YKJ = Finnish National Grid-coordinates, countrywide zone

Definition is exactly same as KKJ zone 3, but YKJ is used countrywide.

ERTS-TM35FIN, Finnish new National countrywide grid

As standard UTM, but used in countrywide zone.

ETRS-GKnn, Finnish new National grid for local area use

Used in 1 degree zones for local area works. 'nn' is the central meridian, e.g. central meridian of ETRS-GK27 is 27 degrees. The zone number (central meridian) is mandatory, because the zone can't be derived from the grid coordinate values (as in KKJ).

INXYID=ID referring to conversion parameters between input-xy-coordinates and geographical coordinates

INXYID is used to define the ID of the grid-conversion parameter-set when the selected coordinate type (INCRDTYPE) requires user defined grid-parameters (e.g. TM or LCC2SP).

When INXYID is defined, Evaluator reads conversion parameters between input-xy-coordinates and geographical coordinates from parameter-file XYPARA.VAL with ID given in XYID, see section "Parameter Files".

Examples of INXYID-values:

```
INXYID=OSGB36
INXYID=RT90
INXYID=KKJ1
```

OUTCRDTYPE=type of the output-coordinates

DEG = Degrees and decimals of degrees
DM = Degrees, minutes and decimals of minutes
DMS = Degrees, minutes, seconds and decimals of seconds
GON = Degrees; full circle is 400 degrees

OUTCRDTYPEs DEG, DM, DMS and GON can be given in simple mode or refined with formatting instructions, which are given as a text-string after the coordinate type. The coordinate type (e.g. DEG) and the formatting instruction must be separated by a comma, e.g.

`OUTCRDTYPE=DEG`	Simple mode (default formatting)
`OUTCRDTYPE=DM`	Simple mode (default formatting)
`OUTCRDTYPE=DEG,+S`	Refined with formatting instruction "+S"

The formatting instruction is a string of characters having following meanings:

Character	Meaning	Default
S	Put Spaces between degrees, minutes and seconds	No spaces
N	Use characters N, S, E and W	Use + and – to indicate the sign
P or +	Use + character to indicate positive values	Only negative values have sign
C	Use comma (,) as decimal-separator	Period (.) used as decimal-separator
E	Use NMEA-style: coordinate,X, where X=N,S,E or W (N/B comma after coordinate value)	
W	Decimal separator always after integer degrees (also in DM and DMS formats)	Decimal separator after integer degrees, minutes or seconds
T	Trailing sign (+,-, N,S,E or W). * Overrides this instruction	Leading sign
Number	Number of decimals (may be overridden in OUTLINEFORM)	3

Some examples

OUTCRDTYPE	Output
DEG	62.909 023.913
DM	6254.545 02354.782
DMS	625432.700 0235446.920
DMS,SN	N62 54 32.700 E023 54 46.920
DMS,SNT	62 54 32.700N 023 54 46.920E
DMS,SNC	N62 54 32,700 E023 54 46,920
DEG,*	6254.545,N 02354.782,E
DMS,W	62.5432700 023.5446920
DEG,6+T	62.909083+ 023.913033+

UTM = Universal Transverse Mercator

If the OUTCRDTYPE is UTM, Evaluator writes the zone-information (Zone-number and Band-letter) in the Zone-field, northing in the latitude-field and easting in the longitude-field. E.g. the OUTLINEFORM below would write standard UTM-coordinate format. Note the order (longitude=easting first, then latitude=northing) and spaces between Zone, easting and northing.

```
@ID@,@Zone@ @Lon,.3@ @Lan,.3@
```

Evaluator selects automatically the correct zone (zone and band) based on the coordinate values, calculates automatically the standard UTM-parameter-values for each zone and optionally reads the exceptional parameter-values from the parameter-file XYPARA.VAL. Read more about this and other information regarding UTM-handling from the description of INCRDTYPE.

TM = Transverse Mercator / Gauss-Krüger projected coordinates

User defined Transverse Mercator projected coordinate format. When this coordinate format is used, conversion parameters between the geodetic and grid-coordinates must be defined in the parameter file XYPARA.VAL and the parameter ID must be set using the parameter OUTXYID.

Fore more details about the needed parameters see section 'Parameter Files", XYPARA.VAL.

LCC1SP = Lambert Conic Conformal projected coordinates, one standard parallel
LCC2SP = Lambert Conic Conformal projected coordinates, two standard parallels

User defined Lambert Conic Conformal projected coordinate format. When this coordinate format is used, conversion parameters between the geodetic and grid-coordinates must be defined in the parameter file XYPARA.VAL and the parameter ID must be set using the parameter OUTXYID.

Fore more details about the needed parameters see section 'Parameter Files", XYPARA.VAL

MERC1SP = Mercator projected coordinates, one standard parallel
MERC2SP = Mercator projected coordinates, two standard parallels

User defined Mercator projected coordinate format.

MERC1SP is the normal Mercator projection, where the only standard parallel is equator. MERC2SP is rarely used Mercator projection with two standard parallels.

When this coordinate format is used, conversion parameters between the geodetic and grid-coordinates must be defined in the parameter file XYPARA.VAL and the parameter ID must be set using the parameter INXYID.

KKJn = x- and y- coordinates of KKJ-zone 0-5
KKJ = KKJ-zone is defined by longitude

The conversion is made by three dimensional seven parameter similarity transformation using datum KKJ. If the zone number is not given, it is calculated automatically from the longitude.

YKJ = Finnish National Grid-coordinates, countrywide zone

Definition is exactly same as KKJ zone 3, but YKJ is used countrywide.

ERTS-TM35FIN, Finnish new National countrywide grid

As standard UTM, but used in countrywide zone.

ETRS-GKnn, Finnish new National grid, Zones (nn)
ETRS-GK, Finnish new National grid, zone is defined by longitude

Used in 1 degree zones for local area works. 'nn' is the central meridian, e.g. central meridian of ETRS-GK27 is 27 degrees. If the zone number is not given, it is calculated automatically from the longitude.

OUTXYID=ID referring to conversion parameters between output-xy- and geographical coordinates

When OUTXYID is defined, Evaluator reads conversion parameters between output-xy-coordinates and geographical coordinates from parameter-file XYPARA.VAL with ID given in XYID, see section "Parameter Files". OUTXYID needs to be defined, when OUTCRDTYPE (below) is xy-coordinate type.

Examples of OUTXYID-values:

```
OUTXYID=OSGB36
OUTXYID=RT90
OUTXYID=KKJ1
OUTXYID=UTM14N
```

Parameter files

General information about parameter-files

Evaluator reads parameters of ellipsoids, datums and xy-conversions from respective parameter-files:

ELLIPS.VAL Ellipsoidal parameters
DATUM.VAL Datum definition parameters
XYPARA.VAL Parameters describing conversions between geographical coordinates and metric xy-coordinates

Parameter-files must reside in the directory defined by the system parameter FVALUE, see section 'installation instructions'.

Parameter-files are text-files which can be edited by normal text editor. It is also possible to set values in the parameter-files using program FVALUE, which is used also to set program parameters.

An example of parameters file as is (text file):

```
Name=Datum,CEM,LAO,FAE,FAN,SCF,Width, Free text
KKJ=KKJ, 27, 0, 3500000, 0, 1, 3, Finnish National Grid
OSGB36=OSGB36,-2,49,400000,-100000,0.9996012717
```

An example of setting parameter values with program FVALUE. (in the command-line or batch-file)

```
FVALUE XYPARA.KKJ=KKJ, 27, 0, 3500000, 0, 1, 3, Finnish National Grid
FVALUE XYPARA.OSGB36=OSGB36,-2,49,400000,-100000,0.9996012717
```

ELLIPS.VAL, ellipsoidal parameters

Ellipsoidal parameters define the conversion between 3D-XYZ-parameters and geodetic parameters (latitude, longitude and height above ellipsoid)

The parameters in ELLIPS.VAL are semi major axis and flattening. Flattening is calculated (a-b)/a, where a=semi major axis and b=semi minor axis. Flattening can be expressed as a division, e.g. 1/298.257223563665

An example of ELLIPS.VAL as is (text file):

```
Name= equatorial radius, flattening, comment
WGS84= 6378137, 1/298.257223563665
WGS72= 6378135, 0.003352779454
GRS80= 6378137, 1/298.257222101
GRS67=6378160,1/298.247167
International= 6378388, 1/297
HAYFORD= 6378388, 1/297
Airy= 6377563.396, 0.003340850522
Bessel_1841= 6377397.155, 1/299.15281285
Clarke_1866= 6378206.400, 1/294.97870
Clarke_1880= 6378249.145, 0.003407561378, DoD
```

An example of setting ellipsoidal parameter values with program FVALUE.

```
FVALUE ELLIPS.GRS80= 6378137, 1/298.257222101
FVALUE ELLIPS.Clarke_1866= 6378206.400, 1/294.97870
```

DATUM.VAL, datum definition parameters

Datum-parameters define the transformation between two 3D-XYZ-coordinate systems, e.g. WGS84 <> NAD27.

The datum-file DATUM.VAL contains parameters for the 3D-similarity transformation between cartesian X/Y/Z-coordinates and the name of the ellipsoid used in conversion between cartesian X/Y/Z-coordinates and geodetic coordinates (φ, λ, h). The 3D-similarity transformation parameters can be given to or from an ECEF-datum, e.g. to or from WGS84 or ETRS89.

The 3D-similarity transformation is done by 7 Parameter Helmert Transformation formula:

```
|X2|   |DX|                 |  1   Rz -Ry |   |X1|
|Y2| = |DY| + (1+m/10^6) * | -Rz  1   Rx | * |Y1|
|Z2|   |DZ|                 |  Ry -Rx  1  |   |Z1|
```

Parameters in the file DATUM.VAL are:

1	1=parameters are given to ECEF-datum, e.g. to WGS84 0=parameters are given from ECEF-datum, e.g. from WGS84
2	Name of the ellipsoid
3-5	DX, DX, DZ = X/Y/Z shifts in meters
6-8	Rx, Ry, Rz = rotation angles around X/Y/Z axis in seconds
9	m = scale factor correction = (scale -1) * 10^6

If you add new datums to the file DATUM.VAL, try to avoid potential errors:
- check, that conversion direction between datum and ECEF-datum, e.g. WGS84, is right (parameter 1)
- check, that ellipsoid is defined in ELLIPS.VAL
- check, that the signs of the rotation angles are consistent with the formula - sometimes angles are given for a formula, where signs are opposite to what is represented above.
- check, that rotation angles are given in seconds
- check, that scale factor parameter is given in ppm (1/million), not ppb (1/billion)
- check, that scale factor parameter is given as scale-1, not scale itself

Conversions between datums are based on three coordinates: latitude, longitude and height above ellipsoid. Most file-formats supported by Evaluator don't store height. In conversions missing height causes a minor error, which however can be totally ignored in navigational usage.

An example of DATUM.VAL as is (text file):

```
Name=ToECEF,Ellipsoid,DX,DY,DZ,rx,ry,rz,m
WGS84=1,WGS84,0,0,0,0,0,0,0.0
KKJ=1,HAYFORD,-96.062,-82.428,-121.754,-4.801,-0.345,+1.376,1.496
Finnish Nautical Chart=1,International,-78,-231,-97,0,0,0,0.0
RT90=0,Bessel_1841,-414.0978567149,-41.3381489658,-603.0627177516,-
0.8550434314,+2.1413465185,-7.0227209516,0.0
OSGB36=1,Airy,+446.4,-125.2,+542.1,-0.150,-0.247,-0.842,-20.49
NAD27=1,Clarke_1866,-8,+160,+176,0,0,0,0
ITRF90=1,GRS80,0.060,-0.517,-0.223,-0.0183,03,0.0070,-0.011
Pulkovo=1,Krassovsky,28,-130,-95,0,0,0,0.0
```

An example of setting datum-parameter values with program FVALUE.

```
FVALUE DATUM.NAD27=1,Clarke_1866,-8,+160,+176,0,0,0,0
FVALUE DATUM.Pulkovo=1,Krassovsky,28,-130,-95,0,0,0,0.0
```

XYPARA.VAL, conversion parameters between geographical and metric xy-coordinates

Parameters in XYPARA.VAL define conversions between geographical coordinates and metric xy-coordinates, e.g. UTM- and Gauss-Krüger- or Lambert Conic Conformal -conversions with different parameters.

Selection of the desired grid-parameter set, a line in the file XYPARA.VAL, is done by setting the value of the parameter INXYID or OUTXYID. E.g. setting `INXYID= SPC CA 5` would select the line below.

```
SPC CA 5=NAD83,W118 00,N33 30,2000000,500000,,M,N34 02,N35 28
```

The order of the data lines or the titles in XYPARA.VAL has no meaning and does not affect the reading of the parameter-values.

The parameter values must be given comma separated in the order described below. If the value of a field is not used, it can be left blank, but the separating commas must still be in place. However, the end of the line after last meaningful value may be left empty.

In the table X indicates a mandatory field.

False Northing and False Easting must be given in the unit given in field UNIT. This unit is also the output-unit of the grid.

Degrees must be given as space separated DEG, DM or DMS format. This format is described in detail in section INCRDTYPE, type 'D'.

Period must be used as the decimal separator, because comma is used as field separator.

No	ID	Name	TM	LCC 1SP	LCC 2SP	MERC 1SP	MERC 2SP
ID	Name	Parameter set ID	X	X	X	X	X
1	Datum	Datum	X	X	X	X	X
2	CEM	Central Meridian = Longitude of Origin	X	X	X	X	X
3	LAO	Latitude of Origin	X		X		
4	FAE	False Easting (in unit defined by UNIT)	X	X	X	X	X
5	FAN	False Northing (in unit defined by UNIT)	X	X	X	X	X
6	SCF	Scale Factor at Central Meridian	X	X	X	X	
7	UNIT	Grid unit, e.g. M or FTUS		X	X	X	X
8	SP1	Standard Parallel 1			X		X
9	SP2	Standard Parallel 2		X	X		
10-	Free text	Free text					

Parameter ID'd starting with UTM are reserved for UTM-handling and can't be used for other purposes.

If the coordinate type is UTM, the parameter values are set automatically by the program, and therefore there is not need to define UTM-parameters in XYPARA.VAL, unless the user wants to use exceptional parameters (other than UTM-standard). In that case the exceptional parameter (e.g. datum), must be defined in XYPARA.VAL, and the parameter ID must be UTM+Zone Number+Band Letter, e.g. UTM03X. E.g. the line below would define, that in UTM-zone 21, band F, Sapper Hill 1943 is used as datum. N/B; that the end of the line after last meaningful field can be left empty.

```
UTM21F=Sapper Hill 1943
```

In coordinate type KKJ all parameters are defined by the program and the parameter setting have no effect.

Datum ID in XYPARA.VAL is referring to parameter-file DATUM.VAL. Therefore it is important to check, that this datum is defined in DATUM.VAL, if you manipulate XYPARA.VAL.

An example of XYPARA.VAL as is (text file):

```
Name=Datum,CEM,LAO,FAE,FAN,SCF,Width, Free text
RT90=RT90, 15.80827777777778, 0, 1500000, 0, 1, M
OSGB36=OSGB36,-2,49,400000,-100000,0.9996012717, M
DE_DHDN-2=DE_DHDN,6,0,2500000,0,1, M
DE_DHDN-3=DE_DHDN,9,0,3500000,0,1, M
DE_DHDN-4=DE_DHDN,12,0,4500000,0,1, M
DE_DHDN-5=DE_DHDN,15,0,5500000,0,1, M
SPC CA 1=NAD83,W122 00,N39 20,2000000,500000,,M,N40 00,N41 40
SPC CA 2=NAD83,W122 00,N37 40,2000000,500000,,M,N38 20,N39 50
SPC CA 3=NAD83,W120 30,N36 30,2000000,500000,,M,N37 04,N38 26
SPC CA 4=NAD83,W119 00,N35 20,2000000,500000,,M,N36 00,N37 15
SPC CA 5=NAD83,W118 00,N33 30,2000000,500000,,M,N34 02,N35 28
NAD27TEXAS=NAD27,99 00 00W,27 50 00N,2000000,0,1,FTUS,28 23 00N,30 17 00N
Morocco1SP=FR_ED50,6GW,,500000,300000,0.999615596,M,33GN
```

An example of setting xy-conversion-parameter values with program FVALUE.

```
FVALUE XYPARA.OSGB36=OSGB36,-2,49,400000,-100000,0.9996012717
FVALUE XYPARA.SPC CA 5=NAD83,W118 00,N33 30,2000000,500000,,M,N34 02,N35 28
```